

The comparison of injuries in boys' amateur epical athletes in three fields: Kyokushin ka, controlling Karate and Aikido

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Abstract: The aim of this purpose was to compare of the dangerous agents of injury in the three martial art fields: Karate, Kyokushin ka, Aikido. The present research is the lasting research that has been analyzed injuries in three last months. The samples of research include 90 Aikido players, 73 Kyokushin ka players, 70 Karate players (with mean and standard deviation age 15.9 ± 1.6 year, high 168.9 ± 6.3 cm, weight 58.5 ± 7.1 kg) from Shiraz clubs. The samples were selected availability and purposefully. The questionnaire of Destamp et al. (2006) was used to collect data and X^2 test was used to analyze data. The results showed injuries in Aikido was (56.3 percent), Kyokushin ka (24.1 percent) and in Karate (19.5 percent). There were sprain injuries in Karate (31.2 percent), strain injuries in Kyokushin ka (29.6 percent) and bruised injuries in Aikido (32.3 percent). The injuries of lower organs were more than other organs in all three fields, in Aikido (68.4 percent), Kyokushin ka (34.9 percent) and Karate (41.3 percent). Also, the partners' technical error in Karate (30.3 percent), Kyokushin ka (23.7 percent) and partners' knockdown in Aikido (29.9 percent) were known as important mechanics of appearing injuries. Generally, few injuries in Karate (70.6 percent), Kyokushin ka (59.2 percent) and Aikido (60.5 percent) have been more than middle, violent, and very violent. The amount of injuries during exercise (80.6 percent) was significantly more than competition (19.4 percent) in all three fields. The measure of injuries of dominant side in Aikido (51.4 percent) and Karate (45.9 percent) were observed significantly further than non-dominant side position. However, there was not the significant difference in Kyokushin ka. Aikido is an encounter sport, nevertheless the control ways of Karate were done under the semi – encounter laws and it causes fewer injuries in this way.

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1. Introduction

The martial arts have originated from China, Korea and Japan including many different fighting techniques without the use of any weapons. The key benefits of these exercises are self-defense, improving physical fitness, flexibility and self-confidence. Today, East Asian martial arts have been widely expanded among the world's young and adolescents. During 10-15 years recently, these martial arts have been increasingly grown so that women apply these exercises for improving their health and defense skills efficiently (2). For example, in small countries like the Netherlands and Belgium, about nine-thousand boys and girls participated in Taekwondo and Karate and twenty-three thousand were included in other fields of martial arts in the Olympic torments and the world championship. The number of children participated in the U.S martial arts matches were about one-million children (18). Also, due to the dramatic movements in martial arts, children are keenly interested in these activities.(2) these exercises can be Karate ,Aikido, Kyokushin ka which have established favorably in the country. In one hand, the incidence of injuries in martial arts is an inevitable process like other crashing sports and athletes of these exercises are mostly susceptible to risky events. In the

other hand, the high number of interested people in these martial arts along with particular rules and techniques have influenced on the number of injuries in this sports but it is not clarified the real differences of these exercises yet. In addition, there have not been carried out any domestic studies in this regard. Researchers in a review study compared the distribution of the injury in the fields of Kyokushin ka , Aikido and Karate in terms of sex, type, mechanism and the areas of injury; the results of this study showed that generally in martial arts. The rate of injury in girls is lower than boys. Based on injury-based areas, the upper limb in Kyokushin ka, head and face in Karate and lower limbs in Aikido confront with the highest rate of injury; in terms of injury, sprain in kyokoshin ka and Aikido and nose-bleeding in Karate have been reported. Kicking in Kyokushin ka, fisting in Karate and doing cycling kicks in Aikido are mechanisms making the related injuries (8). The other research results in terms of 5 martial arts injuries showed that there is a significant difference between difference martial arts and their type and distribution so that the risky agents in Aikido 59%, Taekwondo 51%, Kong-fu 38%, Karate 30% and Tai-chi 14% were reported. In addition, the risky agent of multi-injuries in Aikido is shown three-fold than Karate.

In the field of injury, sprain in Aikido, strain in Taekwondo and Karate, bruise in Kong-fu and Ti-chi have been known as the greatest injuries in this regard. Based on injury areas, it is obvious that the risky injury of hand and neck, hip, upper and lower limbs were higher in Aikido than Karate (25). German researchers also studied the prevalence of the injury in 15017 martial-workers, 18 year old in 5 martial arts fields. Their results indicated that Taekwondo (36%) in compare to Karate (31%) and Judo (7%) had the highest degree of injury. Also, 95% of these injuries were in moderate level (2). Johnson studied the Karate-ka athletes and their injuries in a research and concluded that the head and neck injuries(51.3%), spinal injuries(23.7%), upper limbs injuries(10.5%), lower limbs injuries(7.9%) and other areas 6.6% were taken place in this regard (12). Boss evaluated 1284 martial arts athletes in 642 tournaments with their movies in a research and the results showed that from these 642 tournaments, 182 cases refer to head injuries, 106 cases about muscular skeleton injuries, 91 subjects in the field of respiratory disorders, 83 cases for minor injuries, 173 matches due to the end of tournaments period and 7 matches were stopped for disqualification; he also concluded that the highest force happening on the head during tournaments is the main reason of these head injuries among athletes (5) the researches carried out in the field of martial arts injuries are at least limited and they have been carried out on few sport fields or the only age variable has been considered as the main parameter of injury areas. The prevalence of fighting injuries in one hand and extra expenses and losing injured athletes forever in the other hand representing the necessity of reducing these injuries as possible; thus the sophisticated analysis of these injuries' type and risky factors in terms of health has been considered as the prevention planning of the injuries. Based on this, we have carried out and compared the most risky agents of Karate, Kyokushin ka and Aikido to show the lowest risk for athletes.

2. Material and Methods

The present study is based on a descriptive-comparative and past-view research which has been studied injuries happened 9 months ago. The statistical sample of the study including all Karate-ka and Kyokushin ka-ka which firstly were active as randomly in Shiraz fighter clubs in 1389.' Few clubs were randomly selected, 70 Karate-ka and 73 Kyokushin ka-ka (amateur).

In other hand, because of confined number of participated clubs, all amateur Aikido (90 ones) were taken up randomly in the study. The range of the subject was between: 14-20 year old, 168+6.3cm, 58.5+7.1 kg. A balanced questionnaire form was applied to collect the related data (Destamb and et.al, 2006, questionnaire form)(9) this questionnaire was consisted of two parts: the first part relates to players personal background including age, height, weight, dominant position, activity period, practice hours per each session and the second part refers to the prevalence of injury in both practice and competition hours, injury mechanism, injury type and vulnerable areas to injury and the outbreak of injury in dominant and non-dominant positions. It is remarkably noted that the context authenticity of the questionnaire was submitted by 5 professional sport physicists. In order to reach to internal reliability of the questionnaire of 30 athletes in Shiraz city during two-weeks, the related questionnaire was completed by the use of Cronbach alpha coefficient, 86%. In this research, the intensity of the injuries was based on Desemb standard method (2006); due to the athlete's absence for the related injury. These are categorized into 4 groups:

Low (not to have absence and continue activity), moderate (more than one session and lower than 8 days absence from activity), intense (absence from activity 8-30 days) and very intense injury (absence more than 30 days from activity). The data collecting method was that the researcher is being participated in the exercise location by the written permission of Aikido, Kyokushin ka and Karate federation; then, he gives questions to all the subjects and interview with athletes to complete the answers. It must be noted that, the diagnosis of all injuries was submitted by the related physician during tournaments. In addition, only low injuries were recorded during exercises. In descriptive level, the statistical indices including the mean, criteria deviation, distributions and percents were used and inferential level, the comparison of injury prevalence in each field of Aikido, Karate and Kyokushin ka was assessed by K-test efficiently. It should be noted that, due to few cases lower than 5 and impossibility of inferential statistic; the results were stated as descriptive.' Also, Cronbach alpha coefficient was used to determine the internal authenticity of the questions. The low level of alpha ($p < 5\%$) was considered as significant have used SPSS 17 software and K-test and Excel for plotting diagrams.

Table1. The background and practice degree per session and week.

	Practice per week (session)		Practice per session (hour)		Sport record(year)	
	C.D	Average	C.D	Average	C.D	Average
Karate	1	3.6	0.5	1.8	1.2	2.7
Kyokoshin ka	0.6	3.1	0.3	1.6	1.1	2
Aikido	1.5	3.7	0.2	1.6	2.4	4.1
Total	1.1	3.5	0.3	1.7	2	3.1

The results showed that in general 732 injuries were recorded in three Karate, Kyokushin ka and Aikido. Sport fields; 471 injuries (523.3 injuries in each 100 athletes) in Aikido, 152 injuries (223.5 injuries in each 100 athletes) in Kyokushin ka and 109 injuries (181.65 injuries in each 100 athlete)

were taken place in Karate. The K-test results representing that the degree of happen injuries in Aikido and per 100 people was significantly higher than Karate and Kyokushin ka ($X^2 = 448.46$, $P=0.000$) (table.2)

Table 2. The number of percent and happened injuries proportion

	Karate		Kyokushin ka		Aikido		Total	
	Percent%	Number	Percent%	Number	Percent%	Number	Percent%	Number
Injury number	14.9	109	20.8	152	64.3	471	100	732
Injury ratio per 100 people	19.5	181.65	24.1	223.5	56.3	523.3		

As shown in table3, the results indicated that in Karate, sprain injuries (31.2%), in Kyokushin ka strain (29.6%) and in Aikido (32.3%) bruise were the highest degree of injuries. In sum, sprain (28.7%), bruise (28.7%) and strain (20.5%) injuries were the most common injuries in the present study. ($X^2 = 695.8$, $P=0.000$)

Table3. Type of happened injuries

	Karate		Aikido		Kyokushin ka		Total	
	Percent%	Number	Percent%	Number	Percent%	Number	Percent%	Number
Bruise	30.3	33	32.3	152	16.4	25	28.7	210
Sprain	31.2	34	28	132	28.9	44	28.7	210
Strain	6.4	7	20.8	98	29.6	45	20.5	150
Break/cutting	11.9	13	1.7	8	14.5	22	5.9	43
Nerve disorders	0	0	7.2	34	1.3	2	4.9	36
Fracture	2.8	3	4.9	23	3.9	6	4.4	32
Brain stroke	4.6	5	1.3	6	0	0	1.5	11
Dislocation	2.8	3	0	0	2.6	4	0.9	7
Others	10.1	11	3.8	18	2.6	4	4.5	33
Total	100	109	100	471	100	152	100	732

Table 4 shows the injuries areas in the body. To compare the degree of injury in different areas of the body, other cases were eliminated from the related data. The statistical results indicated that the injuries of lower limbs (41.3%) in Karate, ($X^2=28.5$, $P=0.000$), Kyokushin ka(34.9%), ($X^2=22.7$,

$P=0.000$), Aikido(68.4%), ($X^2=498.6$, $P=0.000$) are higher than head and neck and upper limb injuries.' These results also showed that lower limbs injuries in Aikido are higher than Kyokushin ka and Karate($X^2=355.12$, $P=0.000$).

Table 4. Injured areas of the body

	Karate		Aikido		Kyokushin ka		Total	
	Percent%	Number	Percent%	Number	Percent%	Number	Percent%	Number
Head and neck	26.6	29	5.3	25	20.4	31	12	85
Trunk/bulk	5.5	6	6.2	29	11.2	17	7	52
Upper limbs	25.7	28	20.2	95	32.9	50	24	173
Lower limbs	41.3	45	68.4	322	34.9	53	57	420
Others	0.9	1	0	0	0.7	1	0.3	2
Total	100	109	0	471	100	152	100	722

Table 5. Mechanisms of injury

	Aikido		Kyokushin ka		Karate		Total	
	%	number	%	number	%	number	%	number
Opponent kick	29.9	141	9.9	15	10.1	11	22.8	167
Opponent's tech. Fault	7.2	34	6.6	10	30.3	33	10.5	77
Insufficient warm-up	13	61	6.6	10	2.8	3	10.1	74
Kick into opponent	7.6	36	1.3	2	26.6	29	9.2	67
Lack of physical fitness	10.2	48	5.3	8	4.6	5	8.3	61
Wrong techniques	7.2	34	23.7	36	6.4	7	6.7	49
Hitting on the ground	1.9	9	6.4	7	0.9	1	6.3	46
Getting Feet to feet	4.9	23	5.3	8	7.3	8	5.3	39
Extra pressure	0	0	18.4	28	0.9	1	4	29
Unsuitable surface of the mattress	3.4	16	5.9	9	0.9	1	3.6	26
Previous damage	1.7	8	6.6	10	3.7	4	3	22
Saloon Temp.	3.4	16	0	0	0	0	2.2	16
Extreme tiredness	3	14	0	0	0	0	1.9	14
Others	6.6	31	5.3	8	5.5	6	6.1	45
Total	100	471	100	152	100	109	100	732

In particular, the mechanisms of injuries showed that in general and totally, the opponent kick(22.8%), opponent technical error(10.5%) and the lack of enough warm-up(10.1%) significantly are the highest mechanisms of the injuries ($X^2=377.6, P=0.000$). the technical error of opponent in Karate(30.3), hitting on the ground in Kyokushin ka(23.7%) and opponent kick in Aikido (29.9%) are the highest mechanisms making the related injuries (table5).

Figure 1 shows that there is a significant difference between the prevalence of injury in both exercise and tournament periods.' So, the greatest degree of these injuries relate to practice time (590 injuries); that is, ($X^2=247.1, P=0.000$) in Karate; practice time injuries (83 injuries) is higher than tournament time (26 injuries) ($X^2=29,8, P=0.000$); in Kyokushin ka also the practice time injuries(115 injuries) are significantly higher than tournament times(37 injuries), ($X^2=40,2, P=0.000$), in Aikido also the practice time injuries(392 injuries) significantly are higher than tournament times(79 injuries), ($X^2=208, P=0.000$); the results also showed that the practice time injuries in Aikido are significantly higher than Karate and Kyokushin ka.($X^2=293.61, P=0.000$).

Figure 11. Sensitivity analysis showing predicted model outputs as the indicated parameters(W0, Temp0, X0) altered from -60% to +60% of its default value. (a) Total materials reduction. (b) Total substrate use. (c) Maximum biomass concentration. (d) Maximum temperature. (e) Air flow accumulative quantity. (f) Moisture content profile.

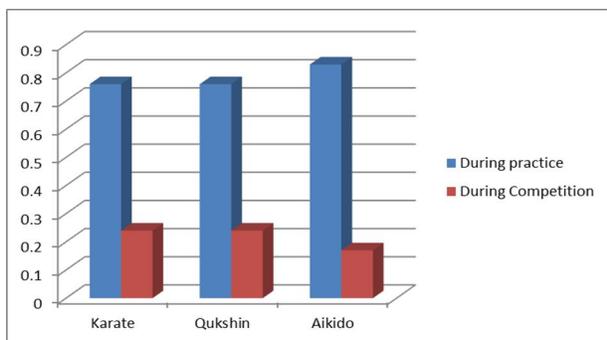


Figure1. The time of injury outbreak

To compare the injury outbreak in dominant and non-dominant positions, the injuries happened in the middle areas of the body were eliminated from the data, and the comparison was carried out based on dominant and non-dominant positions in this regard. The results of K-test showed that the injured degree in dominant area (48.8%) is significantly greater than the lower part ($X^2=16.2, P=0.000$). in

Karate, there is a significant difference between injured degree in dominant position (45.9%) and non-dominant position (21.1%), ($X^2=9.98, P=0.000$). In Aikido and dominant position (51.4%) the injuries are significantly higher than non-dominant part (39.1%), ($X^2=7.89, P=0.005$) while in Kyokushin ka the significant difference between the related areas (42.8% dominant position) and non-dominant part (32.9%) was not found ($X^2=1.95, P=0.162$).

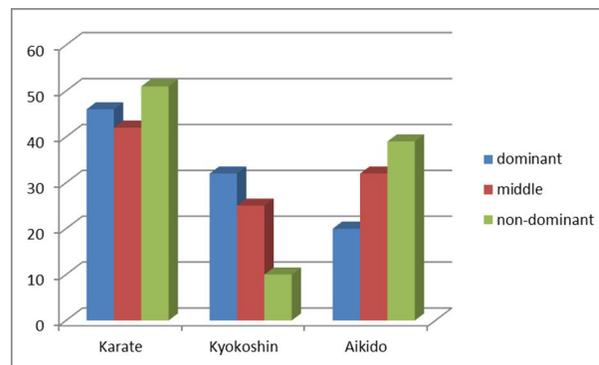


Figure2. Injuries on dominant and non-dominant areas

The information related to the injuries intensity is shown in fig.3. the statistical results representing that the greatest injuries were low(61.7%) which statistically significant ($X^2=347.9, P=0.000$). also, the K-test results showed that these low level injuries in Karate (70.6%), Kyokushin ka (59.2%) and Aikido (60.5%) were greater than moderate, high and very high injuries (fig.3).

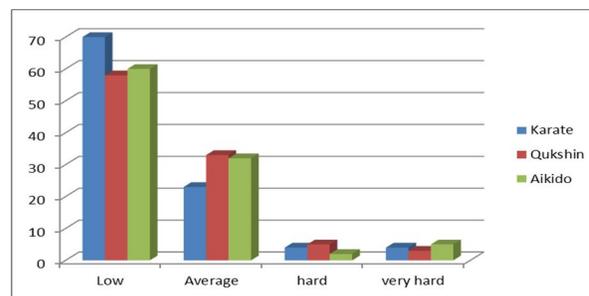


Figure3. Intensity of injuries

3. Results

The obtained results from this study representing that the high degree of injuries prevalence in Aikido and other martial arts is considerably high; Aikido is a complete clashing sport while Karate controlling style is being fulfilled under semi-clash rules, and this makes that sport as the lowest dangerous fighting sport. We recommend Karate controlling style for interested individuals in this regard. Paying attention to some issues like warm-up, techniques recovery,

using protective wearing, confining practice hours and correcting rules can help to decrease any injuries in martial arts.

4. Discussion

The main purpose of the research is to study and compare the prevalence of injury in Aikido, Karate controlling style and Kyokushin ka in amateur male fighters. The results of the present study represented that the injuries happened in Aikido is significantly greater than Kyokushin ka and Karate which are matched to German researcher's results (2). As mentioned before, according to another study, the degree of multi-injuries in Aikido is three-fold than Shotoghan Karate style (25). Smith and et.al (2009) stated that the vulnerability to any damages relates to the activity of athletes. The results of the study representing that injury in sports like Aikido are in high level. In contrast, controlling kicks make the lowest degree of injury (16). Therefore, the degree of injury in Aikido is higher in compare to Karate and Kyokushin ka. In addition to these rules, the degree of injury in each sport field can be effective; the results of Mekan and et.al (2006) showed that the importance of new rules in tournaments is one of the reasons of lowest injuries in prevalence and prevention of these injuries (15). Zetarouk and et.al (2000) also stated that Karate is being done under semi-fighting rules making the lowest injuries in this field (24). The sport background of each athlete can be effective factor in the prevalence of an injury. The results of the study showed that the risky sports like Karate is significantly increasing with athletes sport background (16, 23). In the present study, Aikido-ka athletes had the greatest sport background than Kyokushin ka and Karate-ka athletes which can be one of the reasons of injury prevalence; in this study it is specified that bruise injuries in Aikido, strain in Kyokushin ka and sprain in Karate are the most common injuries from the participants reported. Blocked attacks are the most common prevalence of these injuries. We consider these blockage skills as the most important abilities and using protective tools for preventing any damages is an essential parameter in this regard. The way of achieving joint techniques can be effective in the emergence of these injuries in martial arts. We believe that achieving these joint techniques lead to the high degree of muscular-ligament injuries in martial arts. Moreover, the lack of power and balance in the muscles of the body may cause athletes to muscular-skeleton injuries because the lack of power and correct techniques are related together leading to increase the injuries of tendon and ligaments. In addition to these studies, they have been shown that the incidence of the strain with muscular stretches in the lower limbs of Karate-ka

can happen due to kicking motions without of enough warm-ups (6, 9, 11, 21). It's suggested that practicing with enough warm-up can prohibit any injuries (6, 21). The results of the present study showed that the lower limb is significantly known as the most common injury area in the body and Aikido athletes have faced with lower limbs injuries than Kyokushin ka and Karate athletes. In the recent study, the lower limb in Aikido, upper limbs in Kyokushin ka and head and neck in Karate have been reported as the most well-known areas of injuries. The high usage of feet techniques in Aikido is the high risk factor of injuries. About 80% of these applied techniques in Aikido are kicking by feet. According to this feature of Aikido techniques, it can be studied that due to the high usage of feet, knee to knee kicks and hitting to elbows, the degree of injury in Aikido amateur and professional athletes is happening highly in this regard. Also, in the study it is clarified that the lower limbs is in high-risk area in Kyokushin ka field, will carried out researches, the upper limbs are mostly exposed to the risk areas of injuries in Kyokushin ka (2, 5, 17, 25). The applied techniques and skills in sport fields can influence on the incidence of the injuries in each sport fields. The studies show that, using move-techniques can be essential factor in the incidence of upper limb injuries in Kyokushin ka (17, 25). Of course, the high usage of feet can be a good reason for upper limbs injuries in this study. Completing researches in the field of Kyokushin ka used techniques can be impactful to solve this problem.

In this study, the lower limbs in Karate were in high-risk area which matched to Destamb and et.al (2006) research (9). The lack of using protective tools such as calf-cover and feet-wear during exercise and tournaments by Karate-ka athletes increase the incidence of injuries. Also, kicking without enough warm-up can cause to muscular injuries in Karate. Those, using protective tools for feet and warming-up sufficiently can play key role in prevention of lower limbs injuries in Karate. The results of the study representing that technical faults of opponent in Karate, hitting on the ground in Kyokushin ka and opponent kick in Aikido are considered as the mechanisms of injury in this sport field. We consider the greatest injuries in Karate, 'the opponent technical fault'. The practice of feet and first techniques can reduce the related injuries. Mark and et.al(2011) and Arthur et.al(2006) also believe that the accurate judgments and heavy tools can decrease the degree of injuries in Karate.(16,17) we consider hitting on the ground due to techniques by male athletes as the most essential factor of injuries in Kyokushin ka and wrong application of these techniques can increase the incidence of these

injuries, for Kyokushin ka athletes. The results are matched to other research findings. For getting score in Aikido, the kicks should be down heavily on the opponents. The studies showed that the rapid and heavy feet kicks as un-controlling kicks in Aikido have been down that they can lead to the incidence of injuries of Aikido athletes (7, 22, 23). Anyway, controlling techniques in Karate athletes, correcting Aikido rules and giving precise hitting techniques can be a great background for increasing injuries in Kyokushin ka athletes. Based on the injuries intensity, the greatest degree of injuries relate to low level injuries which is statistically significant Peter(2010) and Halabchi et.al(2007) reported the low level injuries among Karate athletes. The results showed that due to the controlling kicks, the degree of injuries is low and small in Karate (11, 20). According to the results of the present study, we take the lowest risks of injuries among low-experienced and non-professional individuals due to body mass and their low power and ability; we believe that non-professional people are not able to kick heavily like professional ones, so the degree of injury is low. In addition, the results indicated that the greatest degree of injury takes place during practice and tournament times in three Karate, Kyokushin ka and Aikido fields significantly, and the injuries of Aikido is significantly higher than two other ones. The obtained results are matched to the results of Desamb et al. (2006) (9). Researches have called the increase of practice hours per week as a risky factor in the prevalence of sport injuries so that the vulnerability to injury in martial arts with two hours extra practice have been reported in this regard. In a study led by Arthur et.al (2006), they studied that there is a bilateral relationship between the number of session and practice hours with martial arts injuries (17). It is probably the high spending time on practice has been the exact reason for increasing injuries in martial arts. Unfortunately, we have not got the actual time spent by the subjects to explain the regular basis of spending time; therefore, the determination of practice hours and tournaments in martial arts and the study of its relationship with injuries are the topics which can reply to these problem; also, the former researches showed that using protective tools in necessary for fighters during tournaments, but this is not considered at practice hours sufficiently. According to this that only 60% of fighters use protective wearing, it can be concluded that this topic plays a key role in this regard. Due to the lack of enough supervision by coaches, the sample of the study didn't use these protective wearing because of doing easily practices and this makes injuries in high degree during practice hours. According to the present study, to avoid any injuries among fighters

under 18 year old, practicing about three hours per week is reasonable. However, considering accurate practice approaches and using protective wearing can be effective in prevention of any injuries. The results of the present study representing that the percent of dominant position injuries was significantly great in Karate and Aikido but in Kyokushin ka there were no found any significant differences between dominant and non-dominant parts; but it seems that the incidence of injury in dominant part of body is due to an athlete's skills and abilities; even in the present study clarified that injury in the middle part of body than dominant and non-dominant is a little devoted to itself. This can be due to the natural martial arts because most kicks in Aikido and Karate hit to the lateral lobes than middle areas; also the subject studied that the expanded defensive mood through hands and feet come to the middle part of the body during the opponent attack.

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